

Don't lap just yet...



Red Wing

Guide

The perfect valve/casing repair ensures

- ▶ The valves go up and down smoothly and lightly
 - ▶ No matter how off-centered it is pushed down
- ▶ Tolerances are maintained
- ▶ Bearing surfaces are either maintained or improved upon

Lapping is too often used to compensate for overlooked problems on incomplete repairs

- ▶ Scaled/stained casings and pistons
- ▶ Incomplete casing dent removal
- ▶ Bent or untrue pistons
- ▶ Casings warped by
 - ▶ misaligned slides
 - ▶ bent bells/chassis stressing knuckles

Our Rules

- ▶ **Maintain tolerances**
 - ▶ Don't make casings bigger or pistons smaller
- ▶ **Maintain good bearing surfaces**
 - ▶ Improve bad bearing surfaces if possible

We hate to lap

- Tolerance compromise
- Clean-up



Lapping often not necessary

- Focus on fundamentals
 - Knowing all problems
 - Clean, stain-free parts
 - Round/true casings
 - No dents, bends, stresses
 - Round/true pistons
 - Good bearing surfaces

This Clinic

1. Steps to take before lapping

- ▶ Ensuring repairs are as complete as possible
- ▶ Burnishing techniques to manage marginal surfaces

2. Applications for lapping

Piston/Casing Tolerances

Professional

- ▶ 0.0006" – 0.001"

Student

- ▶ 0.001" - .0015"

Shot = Needs Valve Job

- ▶ 0.0015" and up

Shot – Needs Valve Job, but Customer Chooses Not

- ▶ 0.0015" and up



Fixing Casings and Pistons

- If repairs are thorough...no lapping necessary

Instrument inspection



- Bent stem?
- Bent bell/slide/branch?
- Bent/twisted body/parts?
- Something stuck in the port?
 - Pencil, paperclip, toothpick, other
- Plier damage?
- Obvious dents
- Is the problem the piston or casing?
 - Swap pistons around to find out

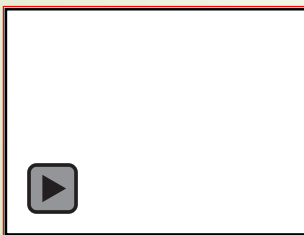
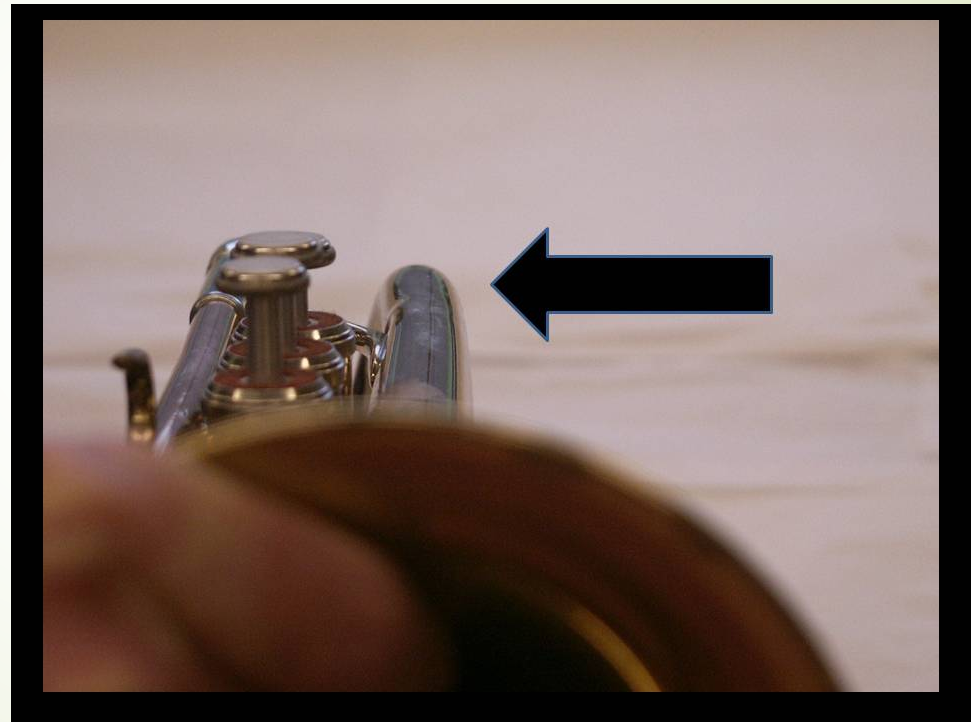


Before removing the piston

- Remove obstructions
- If the piston is really stuck...
 - Straighten and align stuff first
 - Bell/body/slides

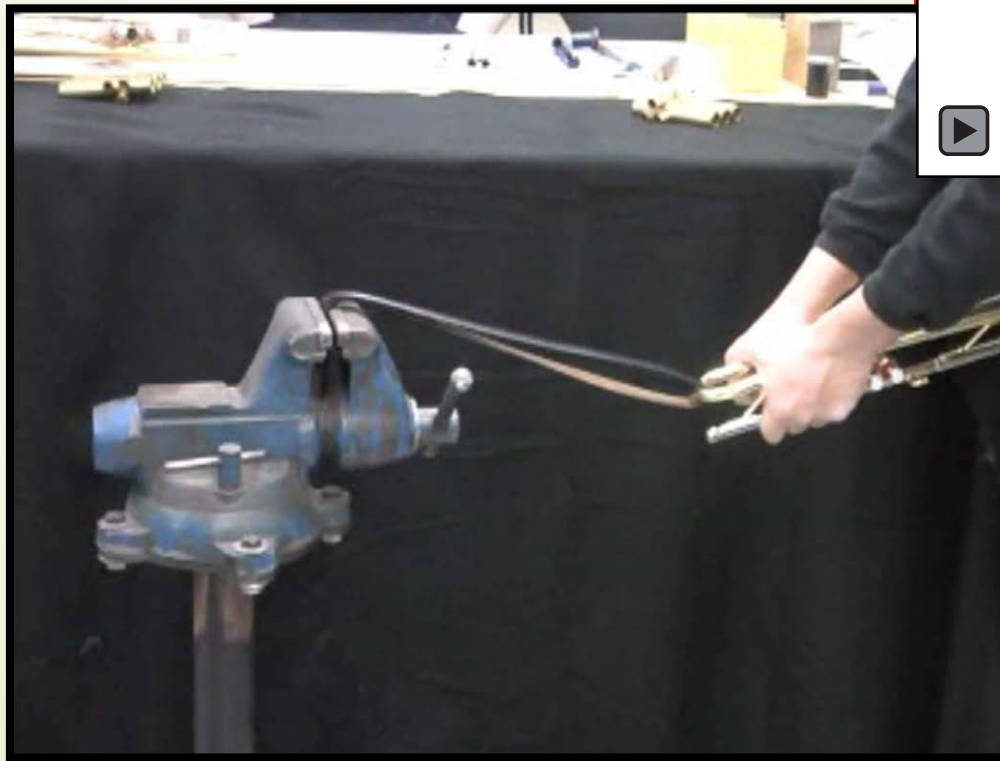
First: Straighten & align stuff

- ▶ Bell bow/tail
 - ▶ Traditional
 - ▶ *Loose vise*



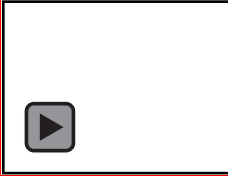
First: Straighten & align stuff

- ▶ Bell bow/tail
 - ▶ "The Frushour snap"



First: Straighten & align stuff

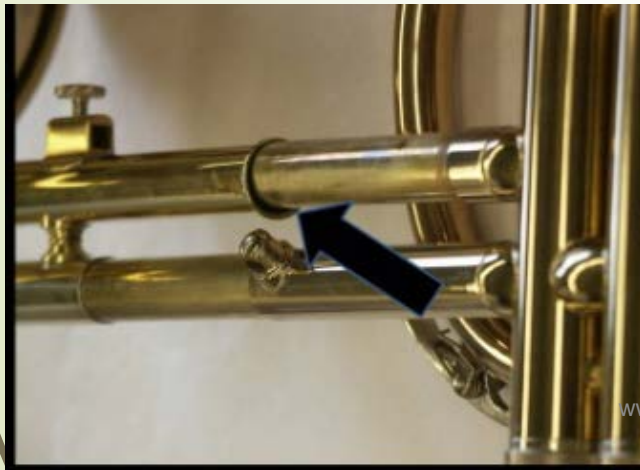
- ▶ Bell bow/tail
 - ▶ Trick: heat ferrules and tubes



First: Straighten & align stuff

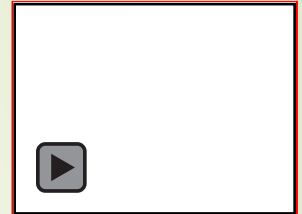
► Slides

- Total slide resistance should be sum of each individual tube's resistance



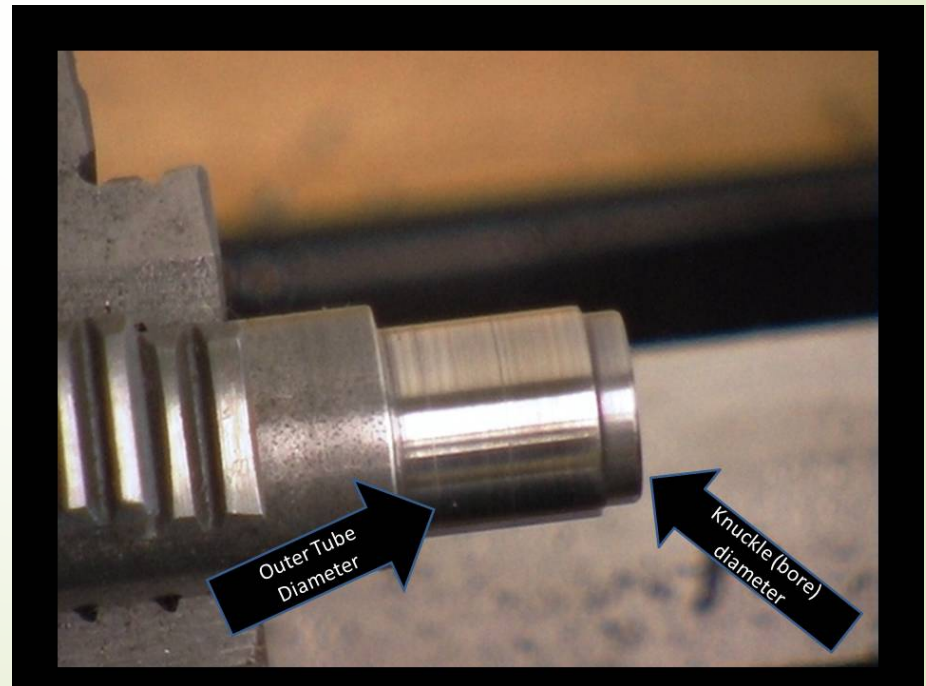
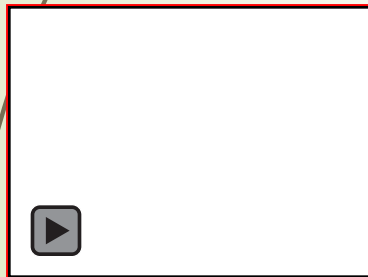
First: Straighten & align stuff

- ▶ Slides
 - ▶ #2 slide on trumpets/cornet
 - ▶ Traditional method

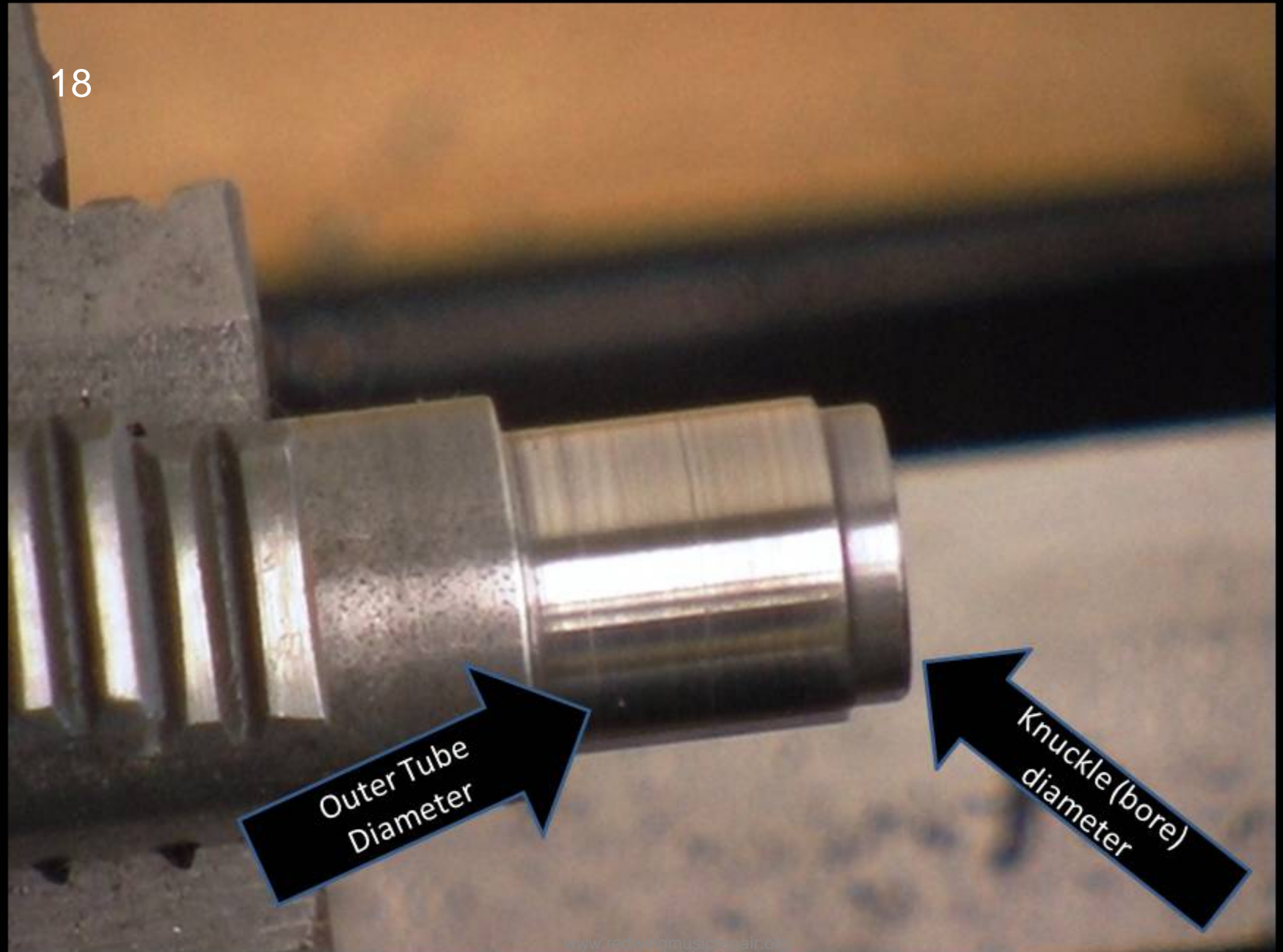


First: Straighten & align stuff

- ▶ Slides
 - ▶ #2 slide on trumpets/cornet
 - ▶ If the knuckle is collapsed



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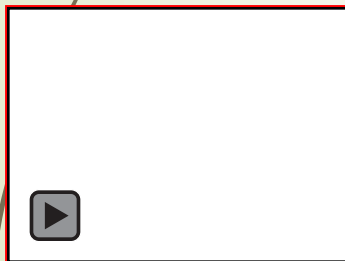
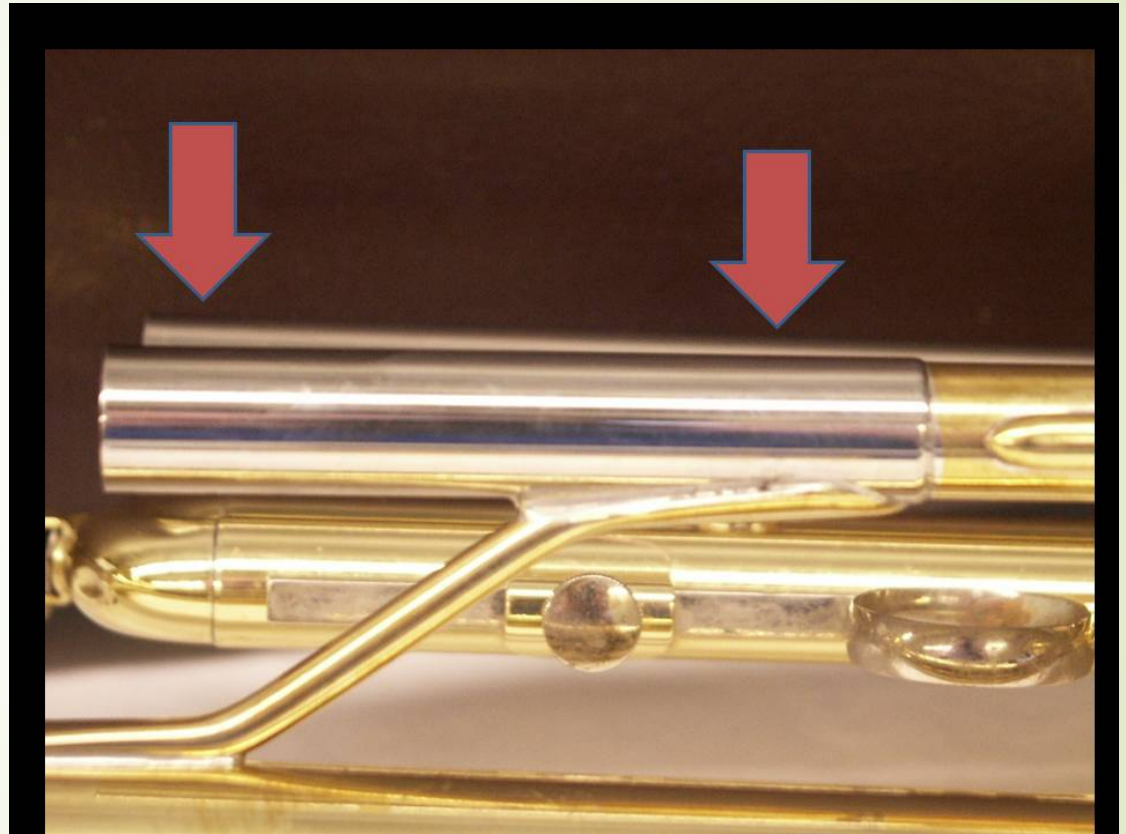


Outer Tube
Diameter

Knuckle (bore)
diameter

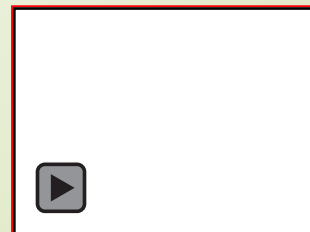
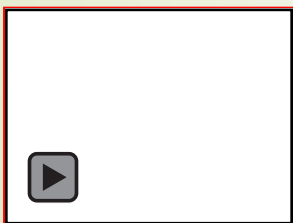
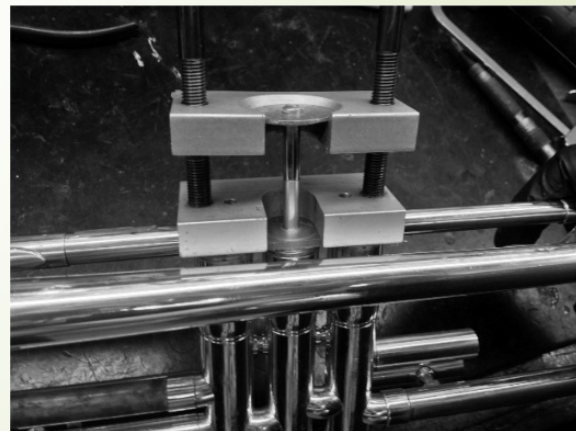
First: Straighten & align stuff

➤ Body



Now, get the pistons out!

- Chuck stem in bench motor
- Piston drivers
 - Allied
 - Make your own
 - BUT match piston outer diameter!
 - Mouthpiece puller
 - Wayne Tanabe/Kevin Blodgett
 - Do **not** use another piston



Clean

- ▶ Casings and pistons gunk and stain-free



Cleaning Rods:
T5047 and T5048

22
22

Stained Monel[®] or Nickel silver

1. Remove stain chemically
2. Mechanically treat surface
3. Oil often
 - *Kerosene-based oils seem to work well*
 - *Synthetics too*



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Clean

- ▶ Casings and pistons gunk and stain-free



Removing casing dents

Rules:

- ▶ Work with a clean instrument
 - ▶ Part of the estimate
- ▶ Casing is dent and obstruction free

Typical order

1. Ferree's ground casing mandrel

Then if necessary:

2. Sharpened solder scraper or Badger State slotted mandrel
3. Votaw/Allied casing laps

- Used as a burnisher at bad spot only

The ground casing mandrel



The ground casing mandrel

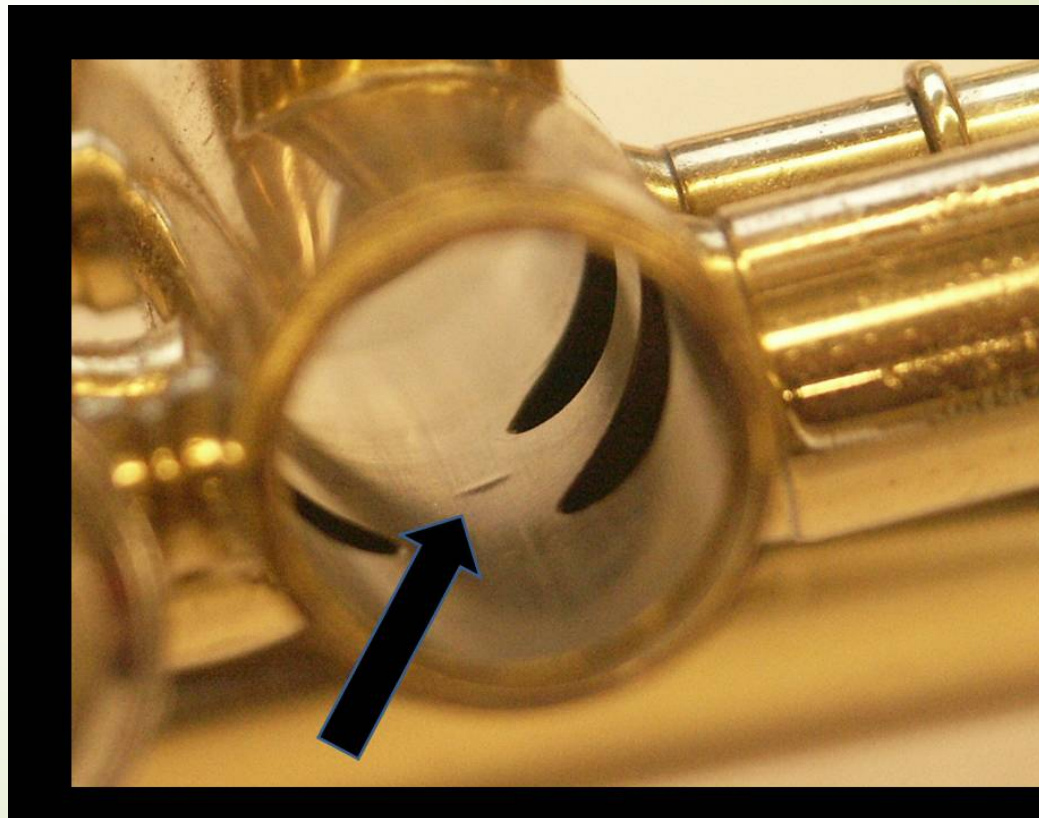
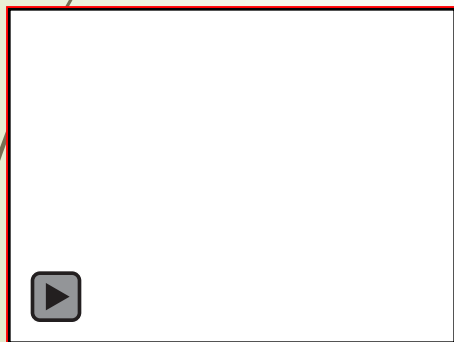
BRASSWIND TOOLS								
BRAND	COR/ TRPT.	ALT/HRN MELLO.	VALVE TROMB	BARI	EUPH.	EB BASS	BBB BASS	JUMBO BASS
Pan Am, Cont, Conn	.682	.714	.714	.828		.888	1.048	1.223
16A	.665							
201 Short Action					.888			
Japanese	.664							
Bach, Mercedes 1	.664	.741		.840 march				
Benge	.658							
Besson—1st line	.685			.776	.923	1.365	1.360	1.365
Student line	.684	.684		.775	.864	.939	.978	
Student line 609 USA	.664							
4 Valve Baritone			.976					
Blessing	.645	.724	.842				.920	
Boosey & Hawkes, Regent	.645				.864		.978	
Bundy	.650		.665		.772		1.062	
Buescher-new	.650				.840		.978 tuba	
-old	.682						1.062	
Couesnon	.668							
Czechoslovakia	.674							
Deg, Dynasty II, 2 Valve					.836			
East German	.686						.916 tuba	
Getzen	.650		.650	.791			.924	
Holton-new, made in USA incl								
Colleg T602	.660						.978	
Old Holton	.650	.668		.802		.922	.922	1.141
Old Collegiate	.668			.791				
New Colleg-Yamaha T602R	.664							
Huttl	.672							
Imperial Creations, Pocket	.644							
Jupiter	.649	.728	.728	.807	.906		1.003	
King	.660	.660	.737	.835			.976	
Marching Baritone				.738				
Cleveland	.661							.936
Leblanc	.660	.660						
Martin, Indiana	.660	.715	.812	.812			1.015	
Meinl Weston							.916 tuba	
Mercedes II, Signet	.650		.665	.772			1.062	
Musica Austria	.673							
Olds	.665	.665	.738	.839			.976	
Orsi	.645							
Reynolds by Olds	.664	.664	.738	.839			.975	
Reynolds by Reynolds	.660			.832			.976	
Roth, Sears, RMC, Reynolds by Blessing, Wards	.645			.837				
Schenkelaars	.657			.893			.893 tuba	
Schilke	.645							
Selmer, French	.661							
Shanghai	.660							
Windsor	.651							
Yamaha	.664	.680		9.25		.947	1.039	
YB 102							.947 tuba	
York	.631							

The whole shebang



The ground casing mandrel

- Step one: rough out the dent



The ground casing mandrel

- **Step two: visual inspection**
 - Go to plastic mallet combination if necessary



The ground casing mandrel

- **Step three: Visual inspection again**
 - If necessary: light steel hammer tap



The ground casing mandrel

- Step four: visual inspection again



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The ground casing mandrel

- Step five: inspect with the piston



The ground casing mandrel

- **This method...**
 - Removes dents more thoroughly
 - Less chance of warping casing
 - Less chance of driving knuckles/braces into adjoining casings

Usually we're done. . .but not always

35

- Sometimes there's a little bit left
 - Option 2: Shave what's left
 - Slotted rod (Badger State)



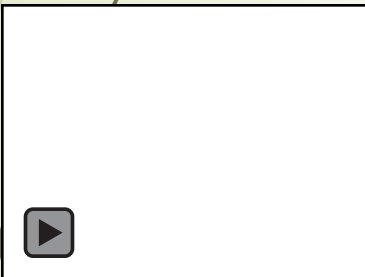
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Usually we're done. . .but not always

36

- ◎ Sometimes there's a little bit left
 - Option 3: Spot burnish the area
 - Allied or Votaw burnishers
 - Barrel laps
 - Sized laps work best



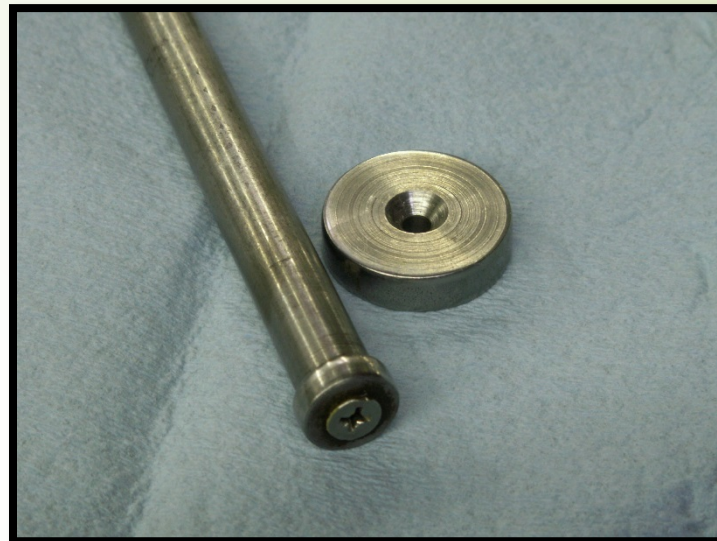
Knuckles and spanner braces

- ▶ Can be pushed into casing wall
 - ▶ Through bell/slide/body mis-alignment
 - ▶ Through extreme stress
 - ▶ Instruments dropped, stepped or sat upon



Knuckles and spanner braces

- ▶ Edge Tapping
 - ▶ Ground casing mandrel
 - ▶ Steel dent hammer
 - ▶ Taper delrin/nylon stick
 - ▶ Casing Burnisher



Pistons: Three typical problems

- ▶ Bent
- ▶ Out-of-round
- ▶ Displaced from dents or other damage

- ▶ Pistons can bend when casings are dented
- ▶ *Pistons can bend/dent/warp when removed from damaged casings*

Always inspect pistons with casing repairs

Rule

- **Pistons must be straight and true**
 - Inspected as part of casing repair
 - Estimate accommodates repair

Now. . .pistons

- ▶ **Tip: Site on a back-lit bench block**
- ▶ What a **bent** piston looks like
 - ▶ Cavity and teeter 180° apart



Now. . .pistons

- ▶ What an out-of-round piston looks like
 - ▶ Have either cavity or teeter - but not 180° apart



Now. . .pistons

- ▶ What a **dented/displaced** piston looks like
 - ▶ Parts of it are too big from dents like this:



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So, if the piston is bent

- ▶ Traditional straightening works fastest and best
- ▶ **Our rule:** *Before checking the piston in the casing, it is as straight as possible (inspected on a flat surface)*



If the piston is out-of-round

► Ferree's casing sleeves

- Takes piston only so far
- Do **not** super-heat then quench
 - Pistons can shrink/sleeve can warp



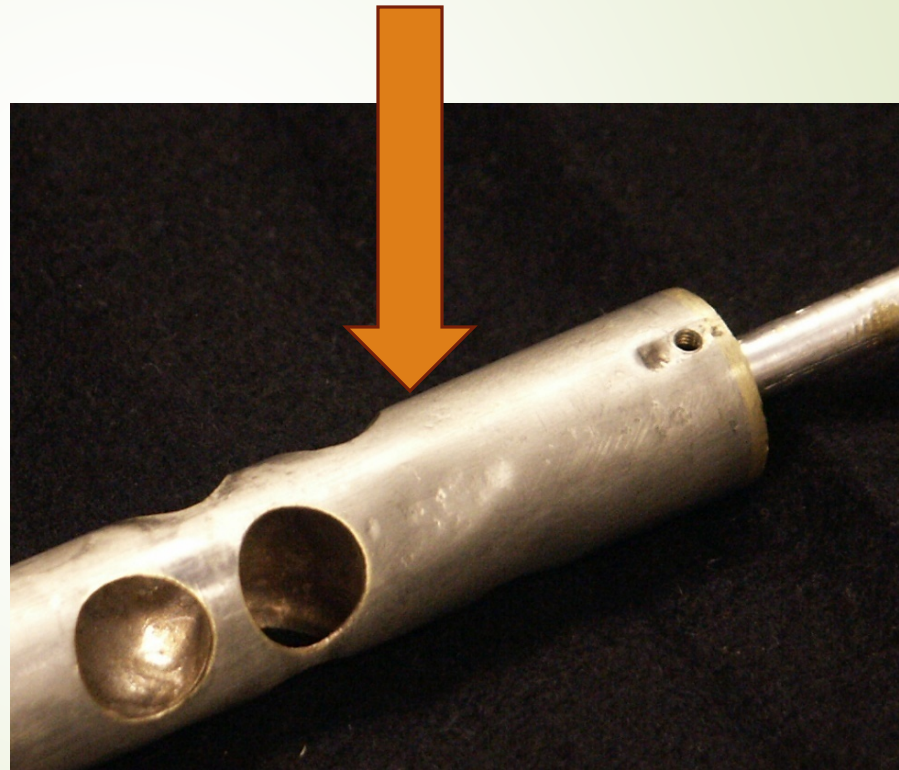
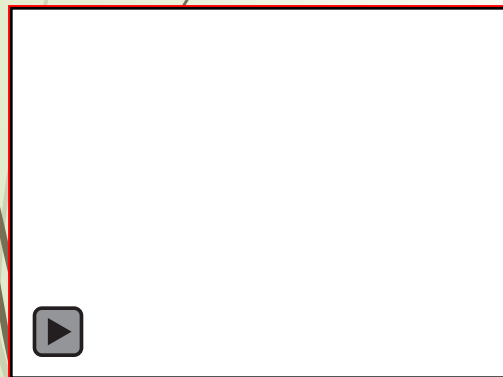
If the piston is out-of-round

- ▶ Ferree's casing sleeves
 - ▶ Split works better
 - ▶ If it warps, cut it in half



If parts are dented/displaced

47



Applications for lapping



Rule:

➔ Know what is wrong

Bad Valve Action

- Slow valves
- Occasionally sticky valves

Bad Valve Action

Observe your surfaces first

➤ good piston surfaces



Bad Valve Action

- ▶ Bad piston surfaces



Stains, Missing Plating, Cross-grain, Cross-hatch

Stained Monel[®] or Nickel silver

1. Remove stain chemically
2. Mechanically treat surface
3. Oil often
 - *Kerosene-based oils seem to work well*
 - *Synthetics too*



Missing nickel-plating

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- Spot buff bad areas
 - To dish exposed base metal
 - and feather edges
- Return to casing



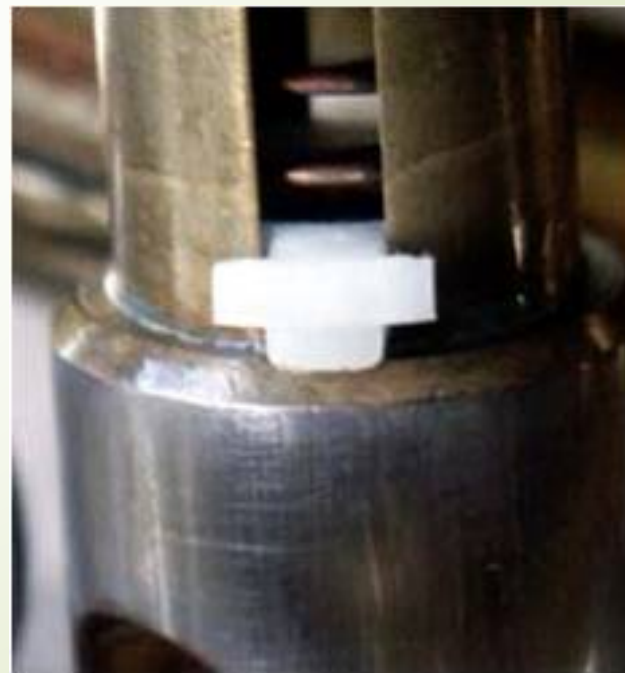
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Cross grain = surface scuffs

Usually not a problem

- ▶ Cross grain = surface scratches or scuffs
- ▶ Can burnish piston if needed



Cross-hatch = surface gouges

Cross-hatched pistons

1. Resurface with Ferree's sleeve + lapping compound
2. Resurface piston with lapping block + lapping compound
3. Burnish piston/casing together



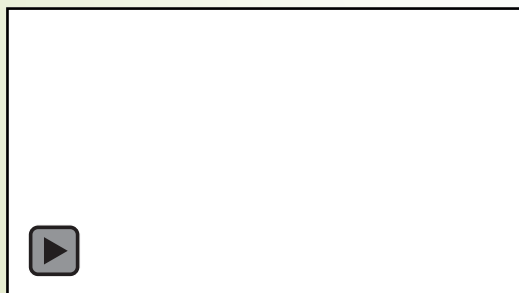
Lapping Compounds

- ▶ **Garnet is our choice**
 - ▶ Ferree's L58 ultra-smooth (1000 grit)
 - ▶ Hetman 1200 grit (Allied)
- ▶ **BUT 1000 + garnet compounds no longer available**
 - ▶ Stay tuned...

Cross-hatch = surface gouges

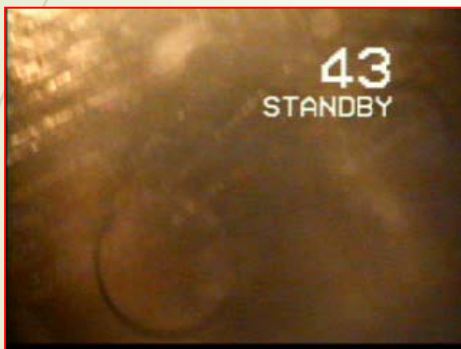
▶ Cross-hatched pistons

- ▶ Resurface with Ferree's sleeve + lapping compound or
- ▶ Resurface piston with lapping block + lapping compound
- ▶ Burnish piston/casing together



Cross-hatched casing?

- Casing inspection
- Bad casing wall surfaces



7mm 6LED USB Waterproof Borescope Endoscope Snake

Item condition: **New**

Length: 2M + Box

Quantity: 1 More than 10 available / 324 sold

Price: **US \$11.68**

Buy It Now

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New condition

Experienced seller

7 inquiries



A banner with a red border showing compatibility with various devices. It features the Android logo, the Apple logo, and a Wi-Fi symbol. Below these are images of an Android smartphone, an iPhone, another iPhone, and a Windows laptop. The labels "Android", "ios", "ios", and "Windows" are placed under their respective images.

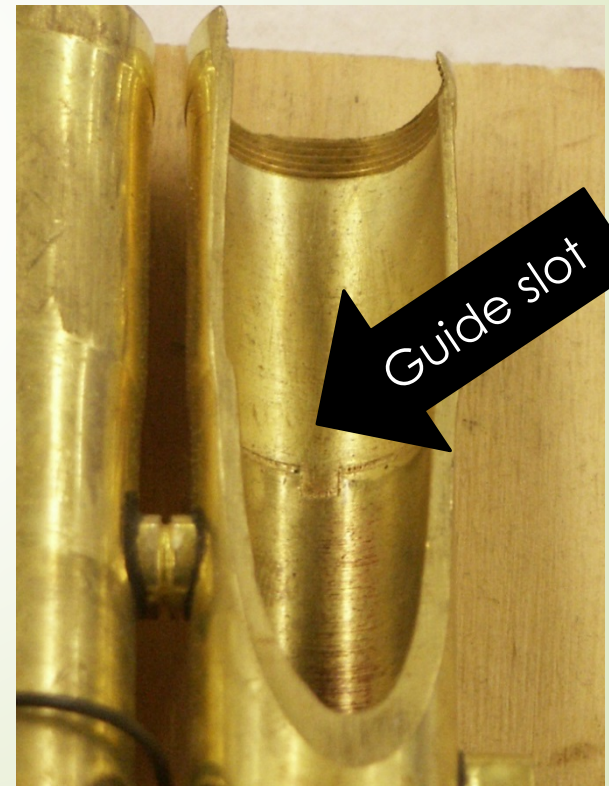
What to do. . .

- **First: Burnish casing/piston together**
 - Hard piston will burnish soft casing wall
- **Second: Resurface casing with ground casing mandrel or Allied/Votaw barrel laps + lapping compound**
 - Laps sized to casings seem to work best here
 - **BUT** be mindful of tolerances.



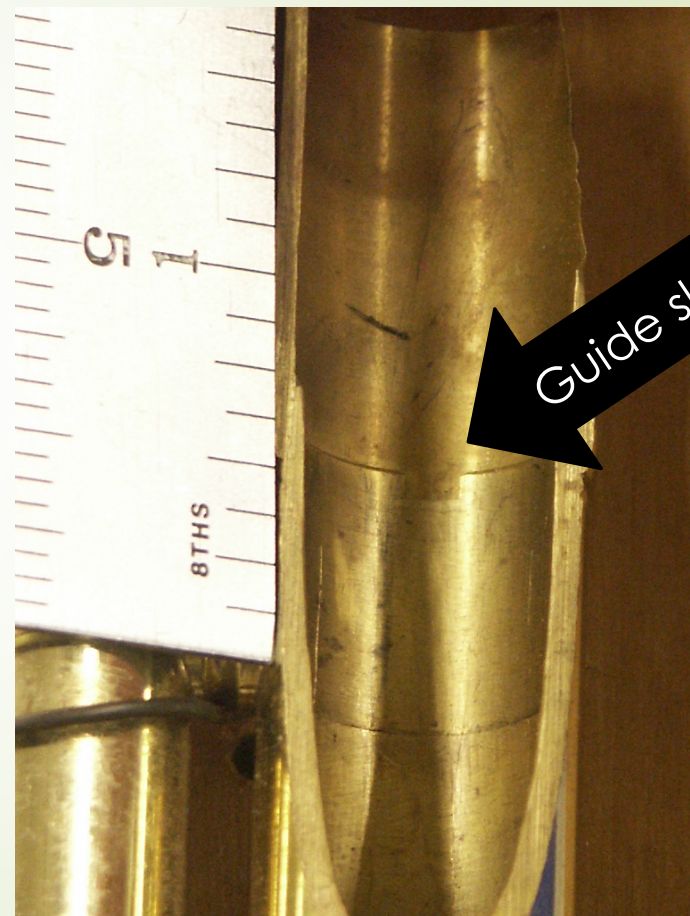
Valve sticks off-center

- Common with top-sprung casing walls that start at the valve guide or just below the valve guide



Valve sticks off-center

- ▶ **Not** common with this kind of casing
 - ▶ Likely an issue with the casing/piston surfaces
 - ▶ Address as discussed earlier



Solution 1 – Burnish First!

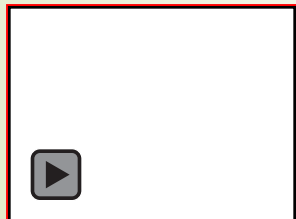
- ▶ Piston/Casing together
 - ▶ With oil
- ▶ Pressing firmly into the sticking
- ▶ Clean-up!



Solution 2 – Increase top space

➤ From Schilke

- Lap just the top $\frac{3}{4}$ " (preferred)
- Or burnish just the top $\frac{3}{4}$ " with a brass lap
 - Size laps recommended



Solution 3 – Slightly Bend Piston

- ▶ Pull piston up out of casing
- ▶ Tap lightly into sticking
- ▶ Tap other way if too far

Other piston problems

- ▶ Valve is getting scratched in the casing
 - ▶ Likely cause: burrs from the valve guide slot
 - ▶ Cure: de-burr with sharp scraper or small craytex wheel
- ▶ Yamaha large brass
 - ▶ Can't remove piston
- ▶ Large brass dent removal
 - ▶ Offset dent ball option



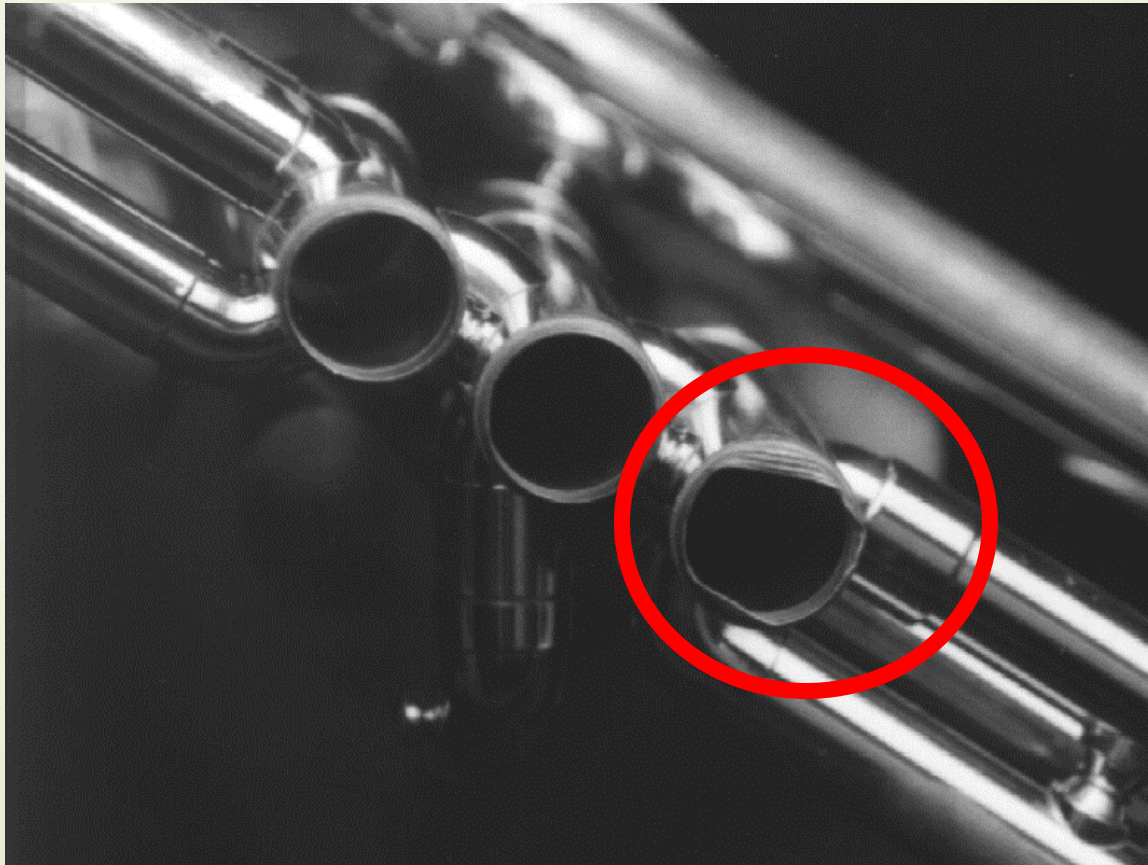
When a valve job?

- ▶ **Playing evidence:**
 - ▶ Poor response (low and high end)
 - ▶ Sagging pitches (during crescendos)
 - ▶ Problems lessen with heavy oil
- ▶ **Our evidence:**
 - ▶ Slop/pressure
 - ▶ Tolerances exceed 0.0015" or 0.002"
- ▶ **Valve re-fit options:**
 - ▶ Handout p.20



Threads

- ▶ See handout p. 5



Dent Ball Method



Dent Ball Method



Dent Ball Method



Dent Ball Method



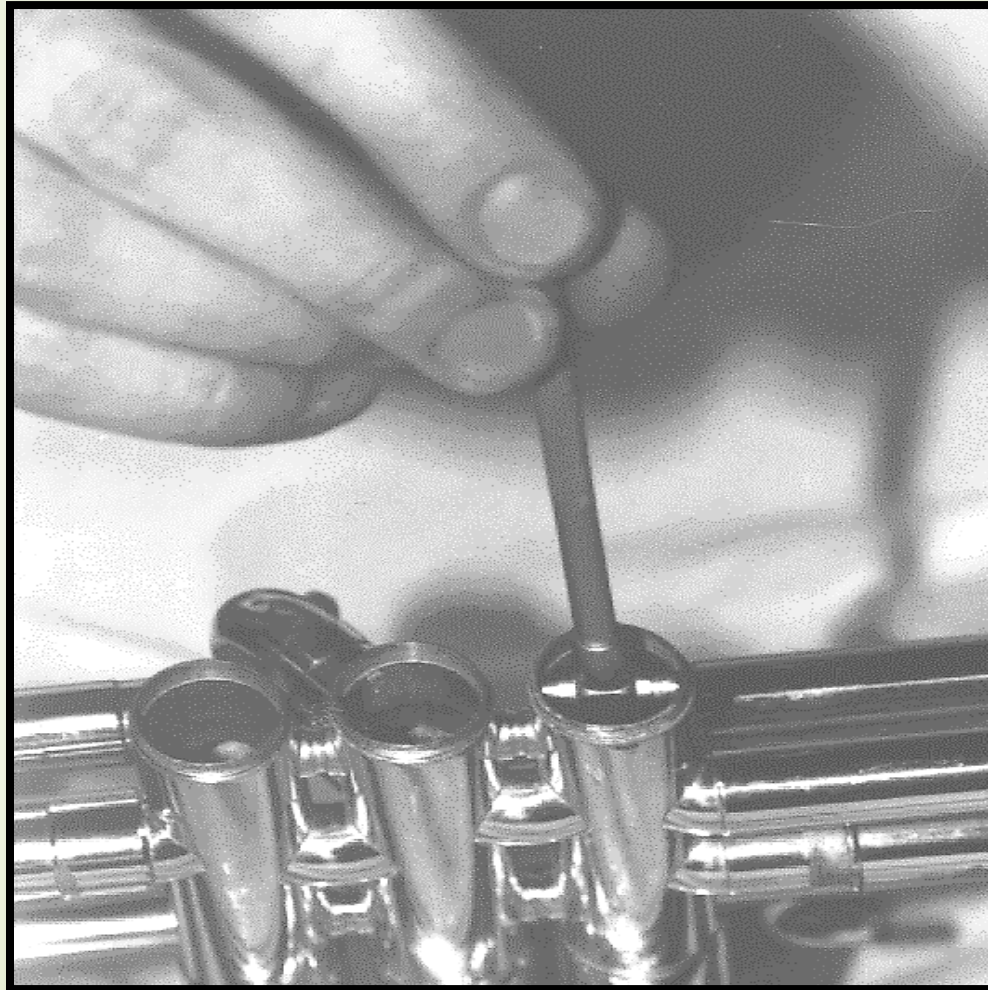
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Standard



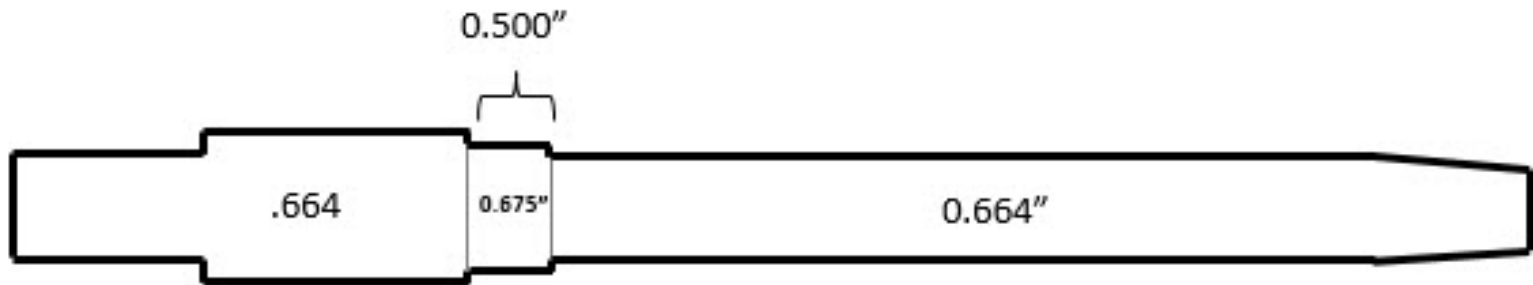
Standard



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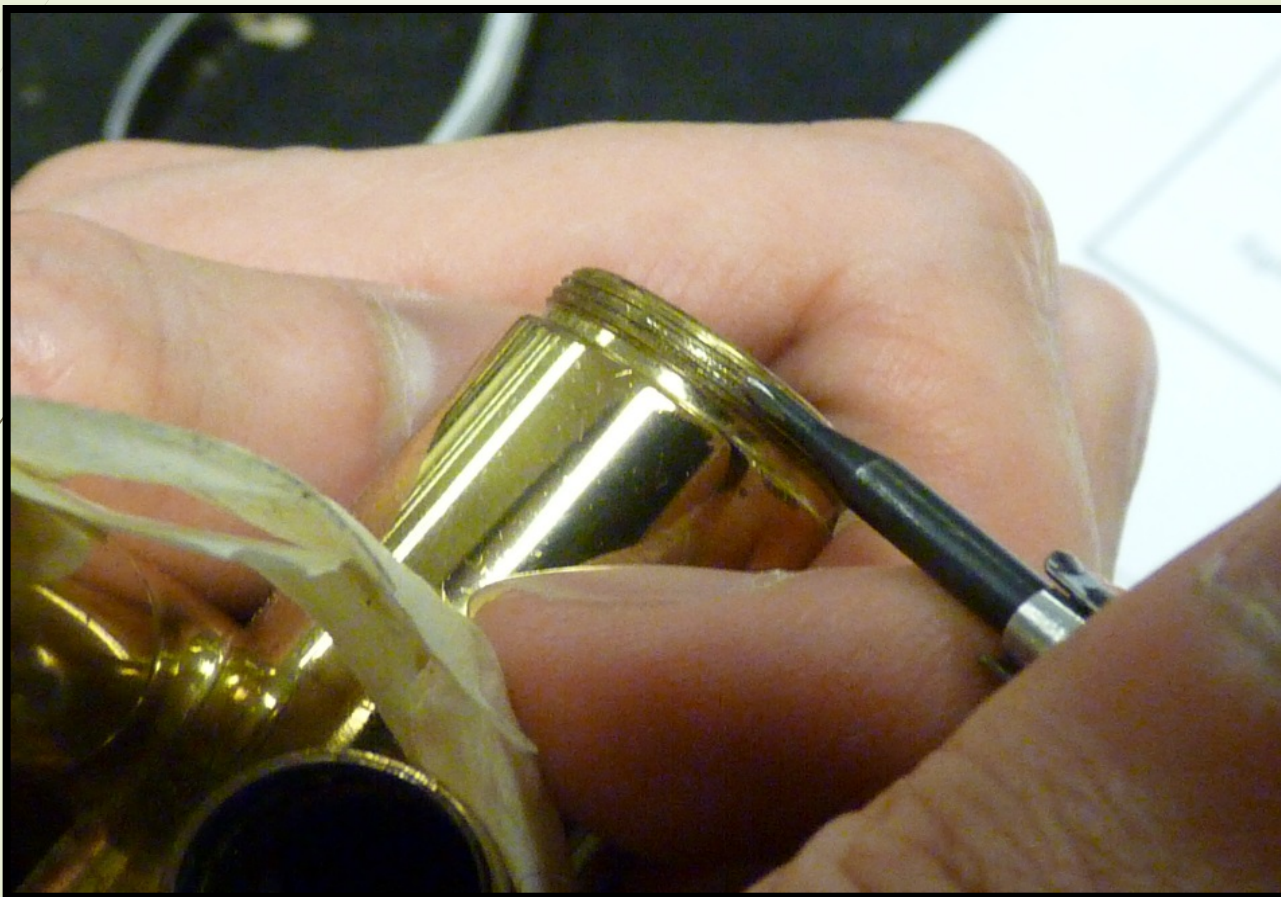
Option with lathe



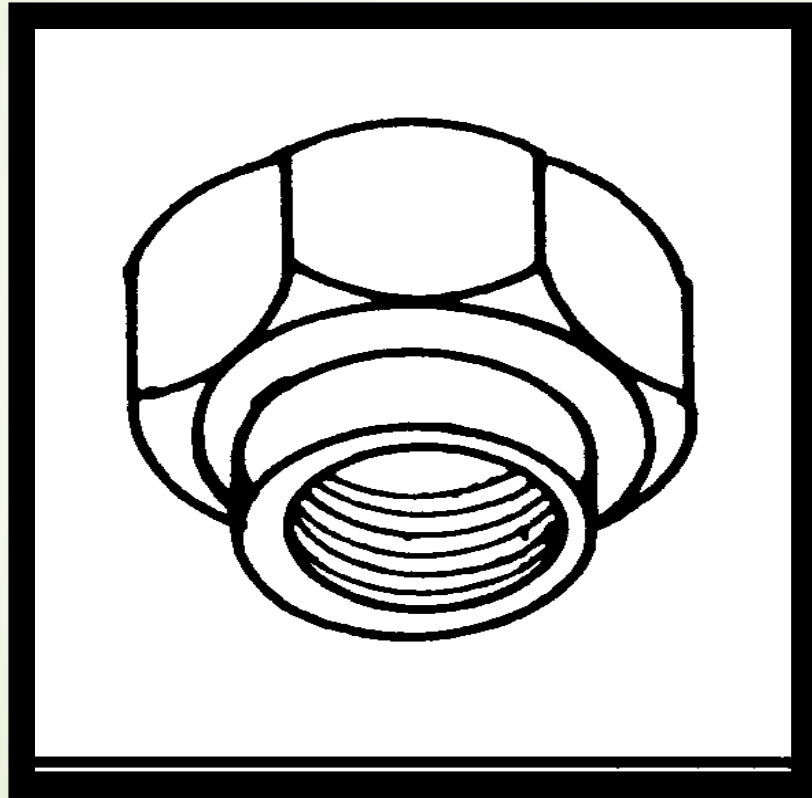
Making the Cap Work



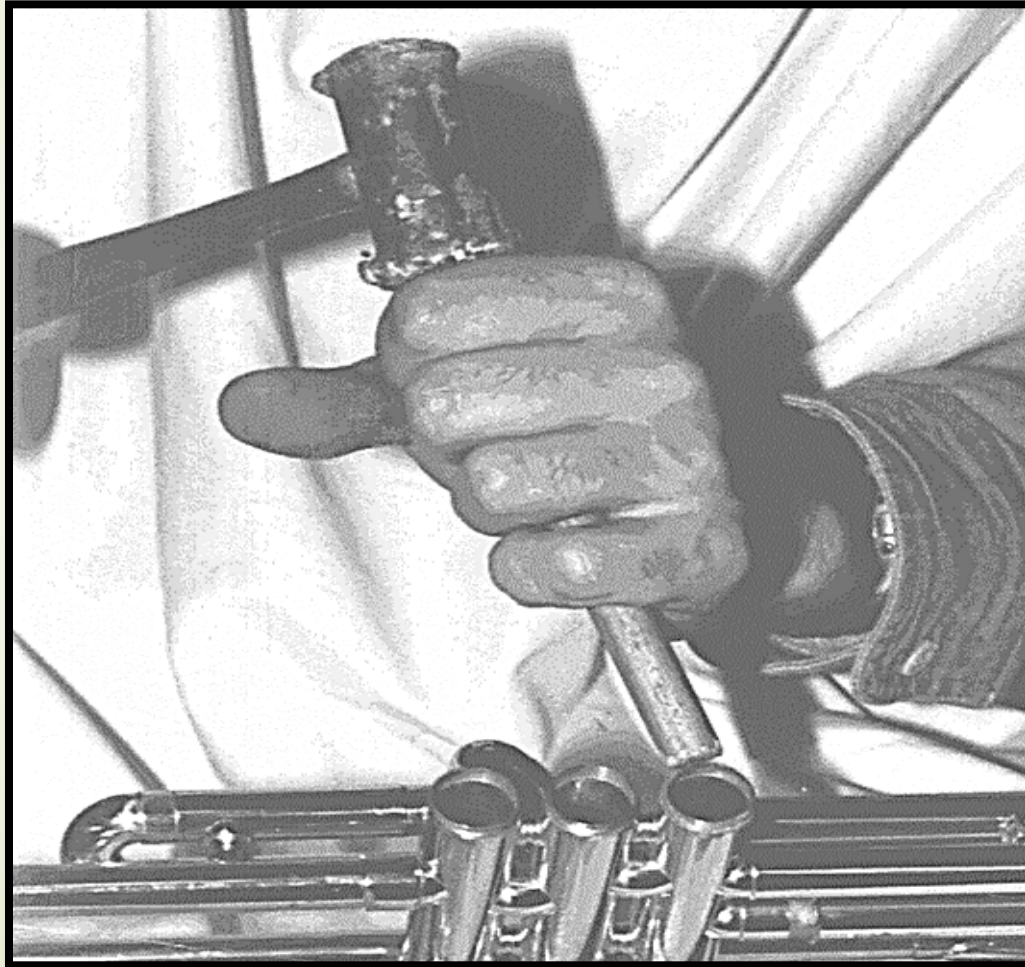
Mushed Threads



Mushed Threads



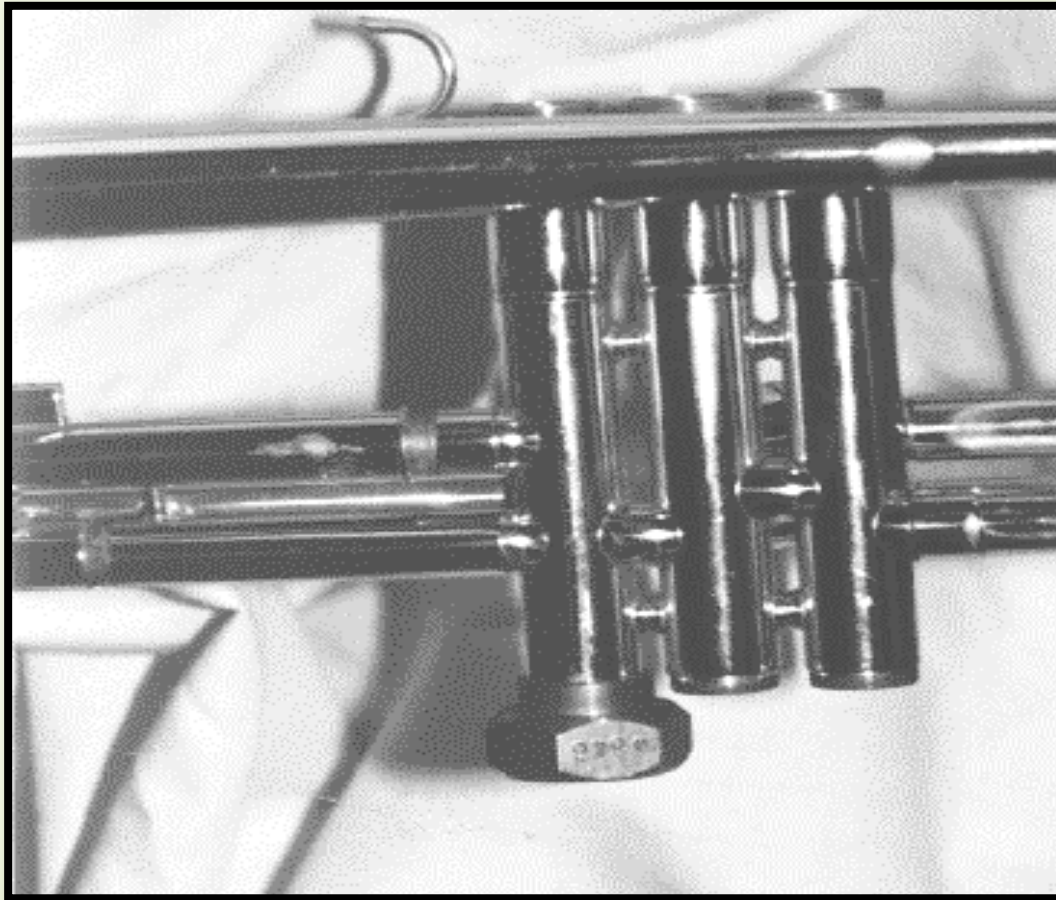
Ferree's Thread Mandrel



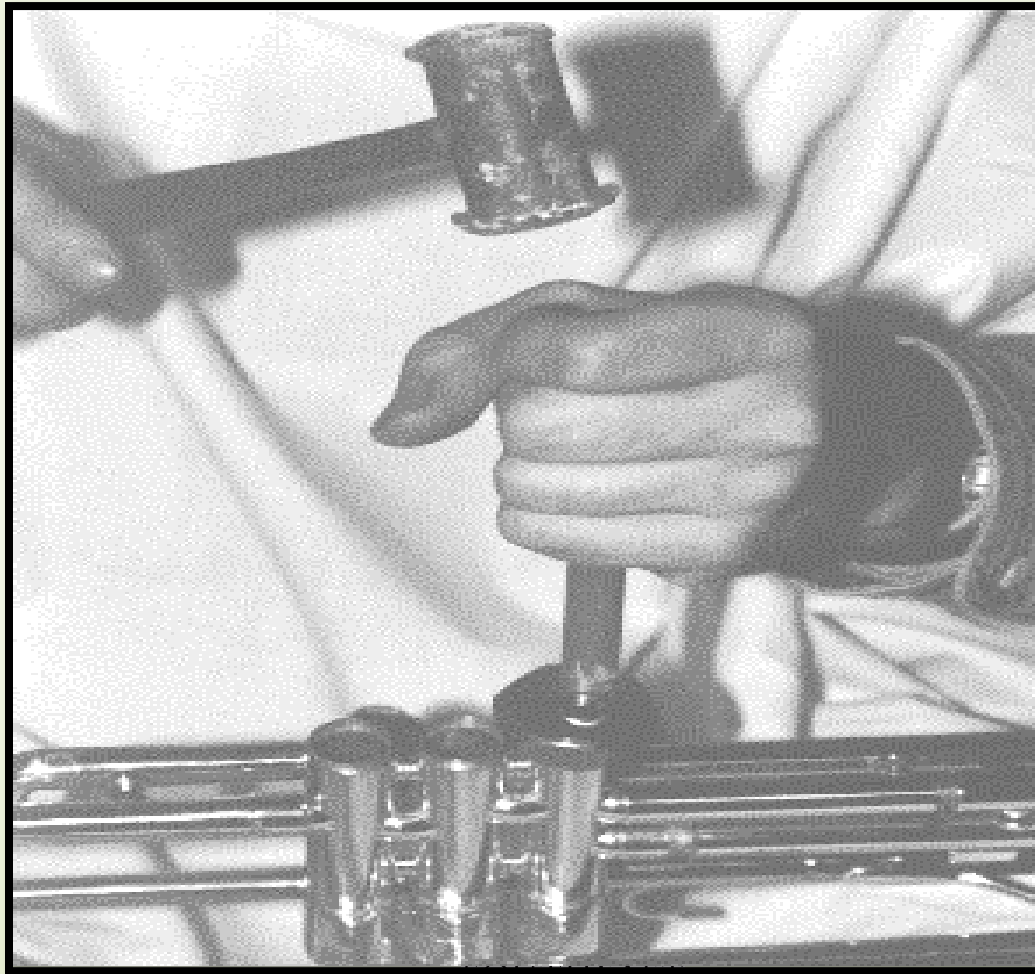
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Ferree's Thread Mandrel

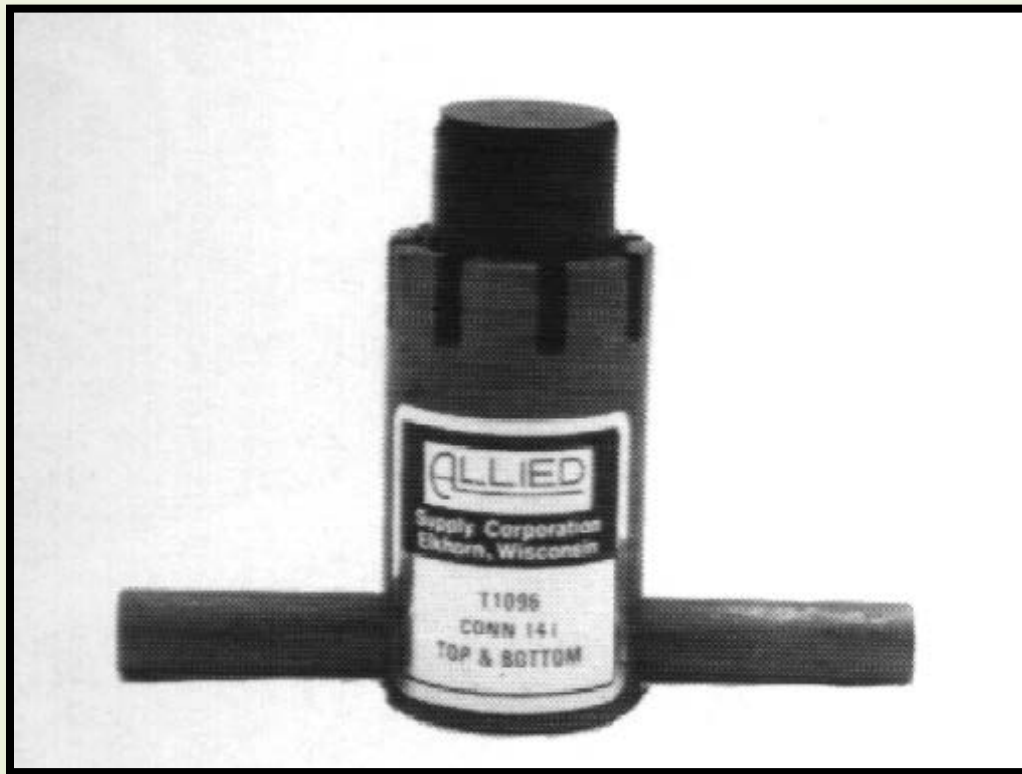


Ferree's Thread Mandrel

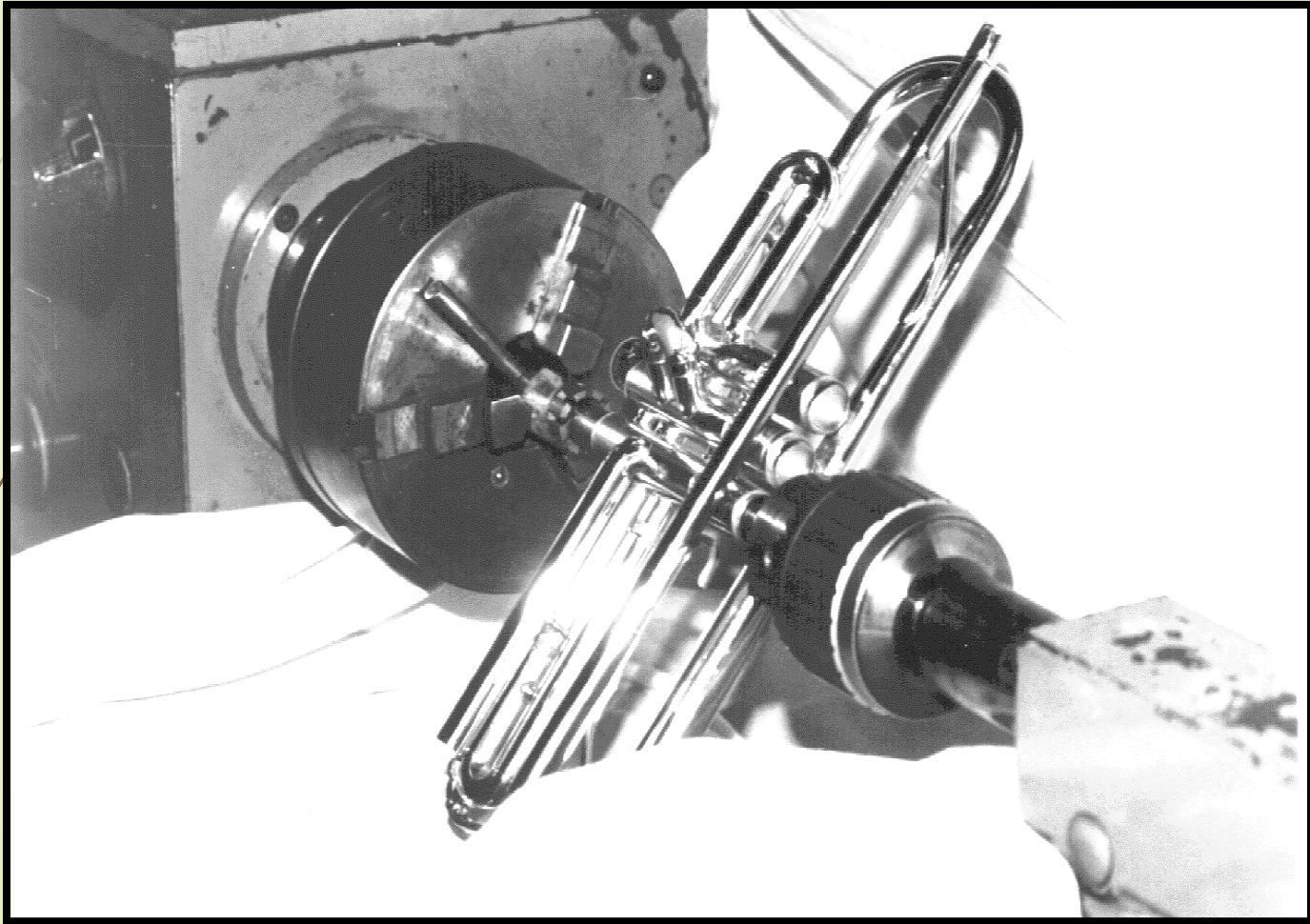


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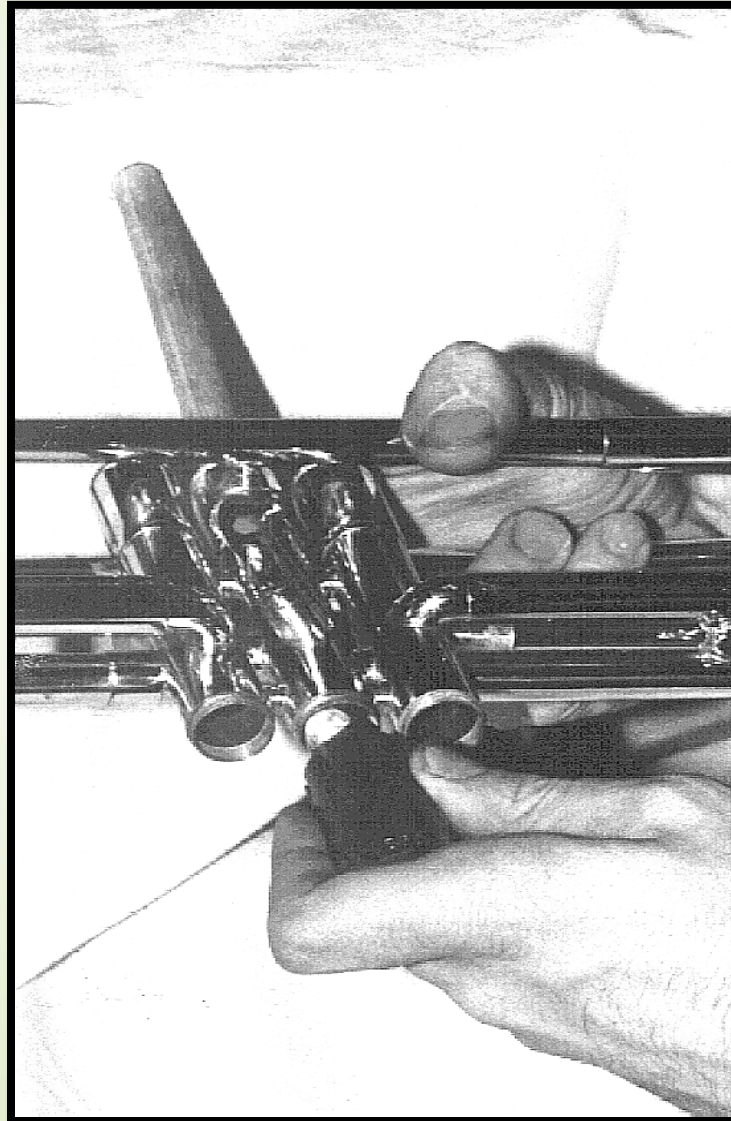
Allied Chaser



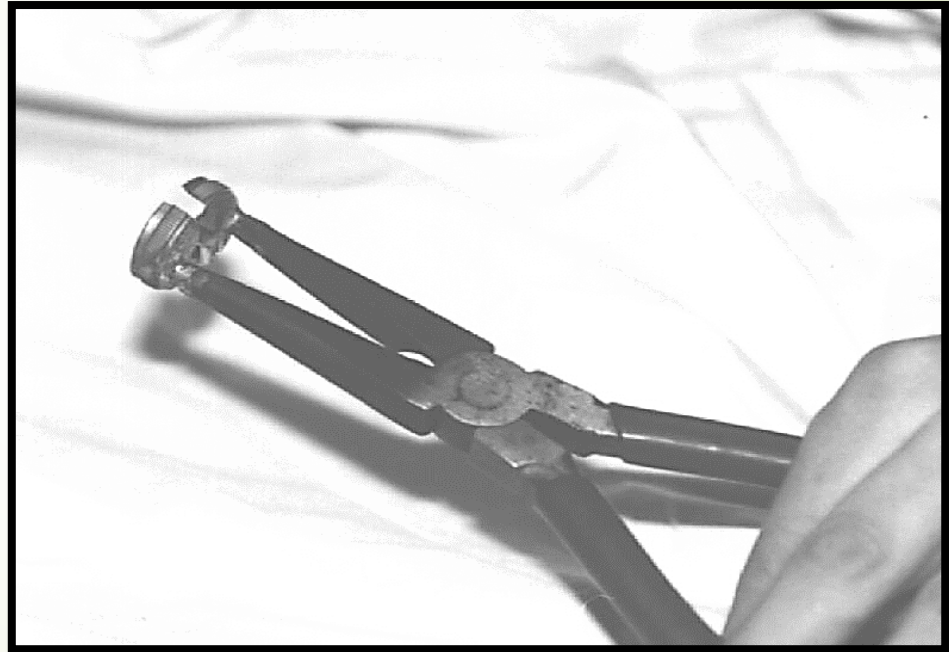
Allied Chaser



Allied Chaser



Valve Cap Pliers



Cool Stuff

- ▶ Solder Bench Pliers:
<https://www.youtube.com/watch?v=8AO7mzYvzKs&feature=youtu.be>
- ▶ [Common Lathe Operations](#)



Thank You!



► Questions?

► Call us: 877-853-8324

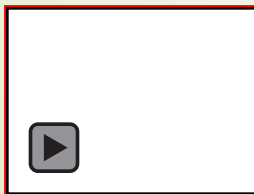
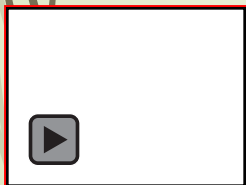
► Email us:

bandinstrumentrepair2@southeastmn.edu



Parking Lot

- [Solder bench pliers](#)
- [Sbrace pliers](#)
- [Pitchfinder Prototype](#)
- [Throat dent roller](#)
- [Bending butter knives](#)




Last resort

- ▶ Burnish the piston round using the lathe
 - ▶ A bit dangerous to the piston
 - ▶ Yet fun to try



Placeholder for now

General Tools & Instruments 93 Adjustable Pin Vise
by General Tools & Instruments
★★★★★ 35 customer reviews

Price: ~~\$13.54~~ ✓ Prime


Note: Available at a lower price from [other sellers](#), potentially without free Prime shipping.

In Stock.
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- Use for electronic assembling, tool-making, model making and hobbies
- Holds small drills, deburrers, wires, files, reamers and other small tools
- 3-jaw hardened steel keyless chuck and sturdy plastic handle

[See more product details](#)

Neiko 20753A 1/4-Inch Shank Keyless Chuck Conversion Tool
by Neiko
★★★★★ 112 customer reviews | 9 answered questions
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- Convert any 1/4-inch hex shank screwdriver into a drill
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